IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants:	T. KAJI, et al.
Application No.:	10/808,559
Filed:	March 25, 2004
For:	A PLASMA PROCESSING APPARATUS
Art Unit:	1792 **CONF. No. 4764**

Notice of Appeal filed: June 12, 2007

REPLY BRIEF IN ACCORDANCE WITH 37 CFR §41.41

MS: APPEAL BRIEF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

August 25, 2008

Sir:

In response to the Examiner's Answer dated June 25, 2008, and in accordance with the provisions of 37 CFR §41.41, applicants respectfully provide the following responses to "Response to Argument" set forth beginning on page 11 of the Examiner's Answer.

(1) Beginning with the last paragraph on page 11, the Examiner's Answer states:

> "First of all, due to the inherent structure and function of the discharge confining means 30 of Lenz '751, the plasma density is increased in the vacuum process chamber. Moreover, the function of the discharge confining means 30 of Lenz et al '751 is to confine the plasma to a smaller region. Additionally, it should be noted that density is indirectly proportional to volume (D=M/V). Thus, when the discharge confining means is applied to the vacuum processing chamber, it reduces the plasma volume, and hence the density is increased. Therefore, the confinement ring 30 of Lenz '751 performs the function specified in the claim in substantially the same manner as the function is performed by the discharged confining means 37 described in the applicant's specification. Therefore, the claimed structure of the discharge confining means is met by the confinement ring 30 of Lenz '751 and thus, the rejection of Lenz et al '751 in view of Ohmi '417 and Lenz et al '356 satisfies the claimed requirement of a discharge confinement means used to increase plasma density within a vacuum processing chamber. "

In response, applicants respectfully submit that this argument in the Examiner's Answer confuses the disclosed function of the ring assembly 30 of the Lenz '751 reference, which ring assembly the Examiner's Answer reads on the claimed "discharge confining means for increasing plasma density in the vacuum processing chamber." As noted in the arguments in the Appeal Brief, an important feature of the discharge confining ring 37 of the present invention, as defined on page 29, lines 7-11, is "to increase plasma density and make the reaction inside the processing chamber uniform." As also argued in the Appellant's Brief, there is nothing in Lenz '751 suggesting that the ring assembly 30 increases plasma density. Instead, because of the structure of Lenz '751, with a slotted assembly having gaps 31 located between rings 32, large openings (i.e., the gaps 31) are provided "through which the spent gasses within the interaction space 17 exit for flowing out of the chamber 12." (e.g., see column 6, line 33 et seq.). The presence of these slots 31 clearly serve to make it completely unlikely that plasma density would be increased

within the interaction space 17 of Lenz '751. The discharge confinement ring 37 of the present invention is specifically designed to substantially completely enclose the plasma chamber with only a small opening for evacuation. In other words, the discharge confinement ring 37 is clearly designed specifically to increase plasma density, as discussed throughout the specification. Nothing in Lenz '751 teaches any such design to increase plasma density, and, in fact, the actual design, with the slots 31, suggests completely the opposite.

In the Examiner's Answer, the position appears the be taken that Lenz '751 ring structure will inherently increase plasma density because it reduces plasma volume due to confining the plasma. It is respectfully submitted that this argument confuses confinement with reducing volume. In fact, nothing in Lenz '751 requires reducing plasma volume. The rings merely keep the generated plasma within a given area. If one pours a pint of water into a glass, the water will be "confined" to the glass, but its density will not be increased. The same holds true here. The fact that Lenz '751 confines the plasma to a processing area doesn't at all require increasing the plasma density by this confinement. Lenz clearly doesn't suggest that plasma density is increased, and the structure that is taught, with a plurality of slots 31, suggests clearly that the plasma density will not be increased.

In addition to the above points, it is noted that, in order to modify Lenz '751 to actually increase plasma density, it would necessitate restructuring Lenz to close off the very slots 31 which Lenz relies on for his neutralizing operation. This would go completely against the entire concept of Lenz '751 of providing a "slotted confinement shield" (column 6, line 16 et seq.) that "includes a stack of quartz rings that are spaced apart to form slots therebetween and that are positioned to surround

an interaction space between two electrodes of the apparatus where a plasma is formed ... to ensure that charged particles of spent gasses in the plasma exiting the interaction space are neutralized by wall collisions as they exit the slots." (Abstract). Therefore, it is respectfully submitted that, contrary to the arguments set forth in paragraph (A) on pages 11 and 12 of the Examiner's Answer, the primary reference to Lenz '751 fails to teach a structure which will increase plasma density within the confinement area, as required by all of the independent claims of this application.

(2) Beginning on page 12 of the Examiner's Answer, parts B and C argue that the fact that Lenz '356 teaches that SiC is well known for a discharge ring material would make it obvious to modify the structure of Lenz '751 to make its rings 32 of SiC to arrive at the present claimed structure. In response, appellant's note that the slotted ring structure 30 of Lenz '751 is very specifically designed "to ensure that charged particles of spent gasses in the plasma exiting the interaction space are neutralized by wall collisions as they exit the slots." (e.g., see Abstract, line 6 et seq.). For this neutralization, Lenz specifically teaches that the rings are formed of high quality fused silica or quartz (column 6, line 16 et seq.). No suggestion at all is given within Lenz '751 of SiC for these very specifically structured rings 32, notwithstanding the fact that Lenz was obviously aware of SiC as a material by virtue of his using it for a plasma confinement ring 34 in Lenz '356. It is respectfully submitted that the clear conclusion of this is that Lenz did not regard SiC as an appropriate material for carrying out the neutralizing operation that he required for the ring assembly 30 of Lenz '751. Given Lenz's apparent decision not to use SiC in the ring structure 30 in the Lenz '751 patent, it is respectfully submitted that it is inappropriate to thus modify

Lenz '751 in an attempt to meet the present claims when such modification would apparently render Lenz '751 inappropriate for its intended neutralization purposes.

Further, even if one were to construct the rings 32 of Lenz '751 of SiC, the resulting structure would still fail to operate to increase plasma density. Specifically, the resulting structure would still have numerous slots 31 that would prevent any such increase in plasma density for the reasons discussed above.

(3) On page 14, in part E, the Examiner's Answer argues:

> "Koshiishi '332 was simply applied to teach that it is conventionally known in the art to u se plasma density of 5×10^{10} cm^{-3} to 5×10^{11} cm^{-3} between the upper electrode and lower electrode in order to perform fine etching with a high etching rate. As stated above, Lenz '751 teaches the structure of a discharge confining means 30 used to increase plasma density within a vacuum processing chamber. Thus, the combinations of Lenz et al '751 in view of Ohmi '417, Lenz et al I'356 (Steger '523 or Ogasawara '200) and Koshiishi '332 satisfies the claimed requirement of a discharge confining means used to increase plasma density at the desired plasma density."

In response, the appellant's note that the claim 28 defines the combination of the discharge confining means to increase plasma density and the feature of the plasma density being 5×10^{10} cm^{-3} to 5×10^{11} cm^{-3} since appellants have found this to be a particularly effective range to etch fine patterns. The arguments in the Examiner' Answer include the statement that "Lenz '751 teaches the structure of a discharge confining means 30 used to increase plasma density." However, as discussed above, this is not actually the case. Therefore, certainly no suggestion is given, other than applicant's own teachings, of modifying the ring structure 30 of Lenz '751 to not only increase plasma density, but also to increase it to fall within the specific range defined by claim 28.

More specifically, in order to actually redesign Lenz '751 to increase plasma density to arrive at the claimed density range, it would be necessary to close off the slots 31 since these slots serve to prevent increasing plasma density. As noted above, this would go completely against the whole design idea of Lenz '751, which is to provide the slots 31 to permit gasses to exit, and to neutralize them as they do so. Therefore, it is respectfully submitted that, contrary to the arguments presented in paragraph E of the Examiner's Answer, claim 28 clearly defines an arrangement neither taught nor suggested by the cited prior art.

(4) On page 16, paragraph H of the Examiner's Answer argues that:

> "However, it is well established in the art to achieve a uniform reaction since it's a desired property in plasma processing of substrates. For example, discharge confining means 73 of Koshiishi '332 restricts the plasma to the processing region and thus is used to perform fine and uniform processing of the substrate (Fig. 10, col. 18, line 28-col. 20, line 36 specifically, col. 18, lines 18-40 and col. 20, lines 9-25). Hence, the discharge confining means 30 of Lenz '751 works similarly by restricting the plasma to the processing region and thus will achieve similar results of a uniform reaction in the vacuum processing chamber. Therefore, the rejection of Lenz '751 in view of Ohmi '417 and Lenz '356 satisfies the claimed requirement."

In response, appellant's point out that there is absolutely nothing in any of the cited references which actually suggest the claimed location of a discharge confining means to not only increase plasma density, but also to maintain a uniform reaction in a vacuum processing chamber. As noted above, although the references teach confinement rings, these simply serve to confine plasma, with no teachings being provided whatsoever in any of the cited references for increasing plasma density. By increasing the plasma density within the chamber, the plasma is also made more uniform in accordance with the present invention. The prior art completely fails to

teach or suggest this. Further, there is no teaching in any of the references to establish the position taken in the Examiner's Answer that somehow this is well known. Accordingly, allowance of dependent claims 33 – 38, all of which are directed to the feature of locating the discharge confining means to maintain a uniform reaction within the vacuum processing chamber is respectfully requested.

(5) Conclusion

For the reasons set forth above, appellant's again request that the Examiner's rejections be reversed.

If the Examiner believes that there are any other points which may be clarified or otherwise disposed of either by telephone discussion or by personal interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Antonelli, Terry, Stout & Kraus, LLP Deposit Account No. 01-2135 (Docket No. 520.35237CV4), and please credit any excess fees to such deposit account.

Respectfully submitted,
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GEM/dks

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